

# Review Thermal, The Atom, Nuclear

Monday, March 06, 2017 10:02 AM

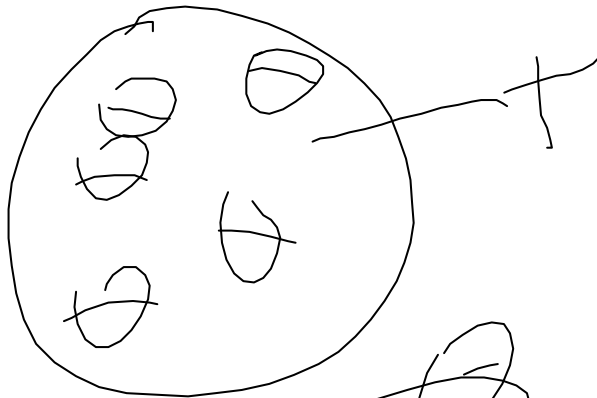
## The Nuclear Quiz

What are the similarities and difference of the Rutherford model of the atom and the Bohr model?

a) Similarities

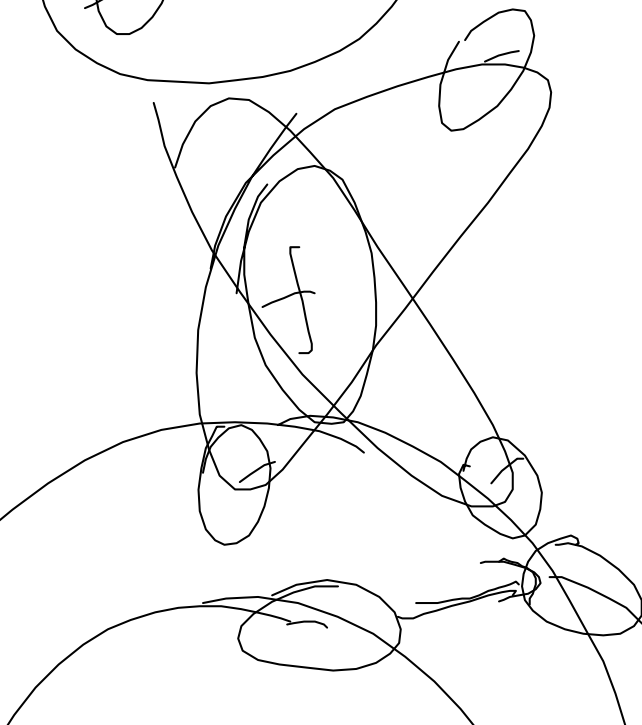
b) Differences

Thompson



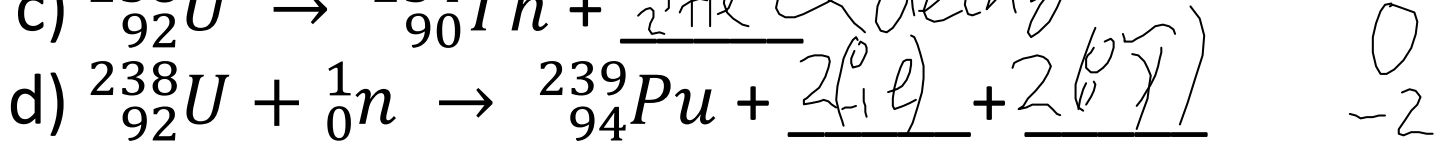
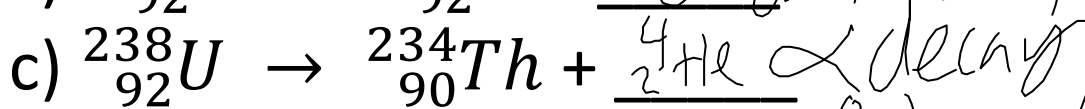
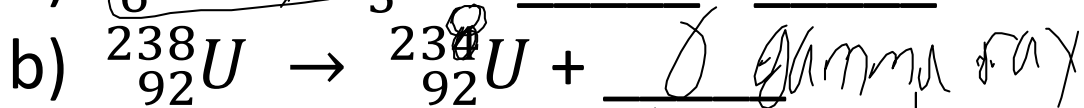
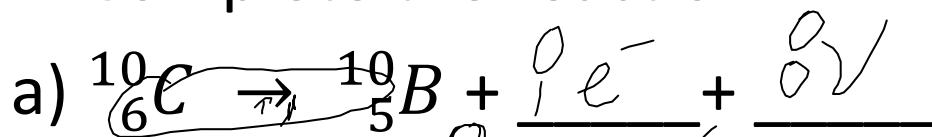
Rutherford

Bohr's





Complete the reaction



Uranium 227 has a half-life of 1.1 minutes. If a sample has an initial activity of  $3.0 \times 10^6$  decays per second, what will be the activity after:

1.1 min

per second, what will be the activity after:

a) 5.5 minutes?

b) 2.0 hours?

$$N = N_0 \left( \frac{1}{2} \right)^{t/t_{1/2}}$$

$$N = \left( 3.0 \times 10^6 \frac{\text{dec}}{\text{s}} \right) \left( \frac{1}{2} \right)^{\frac{5.5 \text{ min}}{1.1 \text{ min}}}$$

$$= 9.4 \times 10^4 \frac{\text{dec}}{\text{s}}$$

$$N = \left( 3.0 \times 10^6 \frac{\text{dec}}{\text{s}} \right) \left( \frac{1}{2} \right)^{\frac{120 \text{ min}}{1.1 \text{ min}}}$$

$$= 4.3 \times 10^{-27} \frac{\text{dec}}{\text{s}}$$

A muon is a subatomic particle with identical properties to an electron but with a much bigger mass,  $1.88 \times 10^{-28}$  kg. If a muon collides with its anti-matter particle, the anti-muon, how much energy, is released as gamma rays?

$$\begin{aligned}
 E &= mc^2 \\
 &= 2 \left( 1.88 \times 10^{-28} \text{ kg} \right) \left( 3.0 \times 10^8 \frac{\text{m}}{\text{s}} \right)^2 \\
 &= 3.38 \times 10^{-11} \text{ J}
 \end{aligned}$$

A muon is a subatomic particle with identical properties to an electron but with a much bigger mass,  $1.88 \times 10^{-28} \text{ kg}$ . If a muon collides with its anti-matter particle, the anti-muon, how much energy, is released as gamma rays?

What is the mass defect, in units of u, and binding energy, in MeV, of Nitrogen 14,  $^{14}_7\text{N}$ ? The isotopic mass is 14.003074 u while the mass of a proton is 1.007825 u and a neutron is 1.008665 u.

$$^{14}_7\text{N} \quad \text{neutrons} = 14 - 7 = 7$$

$$7(1.008665\text{u}) + 7(1.007825\text{u})$$

$$= 14.11543\text{u}$$

$$14.003074 - 14.115431 \\ \Rightarrow 0.112356$$

$$\text{binding energy} (-0.112356)(931.5 \frac{\text{MeV}}{\text{u}}) \\ = 104.7 \text{ MeV}$$